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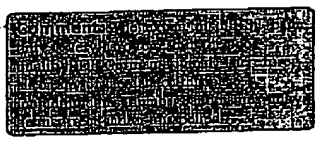

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Description

The invention relates to a mower, including a mower cutter bar, which extends substantially over the entire mower width, having the characteristics specified in the preamble of applicable patent specification 1.

A mower is known from DE-OS 28 39 841, which features a mower cutter bar, which extends substantially over the entire mower width, with a plurality of rotatably drivable mower discs being disposed on the upper surface of said mower cutter bar. The outer mower discs in each case are provided with drums, which transport the harvested crop to the middle and to the rear. The centers of the two outer drums are interconnected at their upper ends via a mower frame. This mower therefore has the disadvantage that the driving means required to drive the mower must be disposed at least partially to the side of the mower. Since it is not permitted to exceed an admissible transport width, a restriction on the mower width is unavoidable. Moreover, if the arrangement is maintained for more than three mower discs, the mower frame increases the weight of the mower, which is undesirable in terms of adapting to soil conditions.

The task that forms the basis of the present invention is to create a mower with a large working width, which, in particular, is distinguished by high stability in a lightweight design. A further supplement to the task is to design the mower in such a way that the necessary driving means can be accommodated within the mower width.

The invention solves the specified task by means of the measures stipulated in the characterizing portion of patent specification 1. The mower according to the invention features high stability with relatively low weight combined with a large working width, which can extend to the maximum admissible transport width.

Subclaim 2 addresses a preferred structural embodiment of the mower.

The measures proposed in subclaim 4 enable the formation of a free space above the inner drum that faces the tractor in which driving elements to drive the mower can be accommodated in such a way that they lie within the mower width.

Further, advantageous features are to be drawn from subclaims 5 to 8.

Further features essential to the invention and the resulting benefits are to be drawn from the following description with the aid of an example embodiment.

The drawing comprises the following figures:

Figure 1 shows a schematic top view of a drawn agricultural machine with a mower and a conditioning apparatus;

Figure 2 shows a schematic rear view of the agricultural machine according to Figure 1;

Figure 3 comprises a partially sectioned top view showing details of the agricultural machine according to Figure 1;

Figure 4 shows a rear view of the arrangement according to Figure 3 without the conditioning apparatus;

Figure 5 shows a lateral view of the agricultural machine according to Figure 3;

Figure 6 shows a section along the line VI-VI in Figure 1;

Figure 7 shows the agricultural machine with mower and conditioning apparatus in its retracted transport position;

Figure 8 shows the agricultural machine according to Figure 7 with means to lock the conditioning apparatus in the retracted transport position; and,

Figure 9 shows the agricultural machine with the mower in its working position and the attached, though inoperative, conditioning apparatus.

Figures 1-5 show the basic design of an agricultural machine with a mower and a conditioning apparatus.

The agricultural machine shown in schematic top view in Figure 1 disposes of main frame 1, which, viewed in relation to the direction of travel, is preceded by mower 2 in a manner that will be described in more detail below and followed by conditioning apparatus 3 in a manner that will also be described in more detail below.

Subframe 4 extends in parallel to main frame 1. Subframe 4 is pivotably mounted on bearings 5 and 6 of main frame 1. Extension arms 7 and 8 are attached to subframe 4 in proximity to bearings 5 and 6. The free, downward-pointing ends of extension arms 7 and 8 carry wheels 9 and 10, by means of which the agricultural machine supports itself on the soil surface.

In a similar manner to subframe 4, mower frame 11 of mower 2, which has relative movement to main frame 1, is coupled to this latter element.

Additional bearing 12 is provided on the end of main frame 1 shown on the left of the drawing. This additional bearing accommodates partially depicted towing device 13 in a lockable and pivotable mounting. Towing device 13 is connected with a tractor or similar device that is not shown in the drawing. Towing device 13 can be rotated out of the position shown, which corresponds to the working position, in which the agricultural machine works to the side of the tractor, into a position shown in the drawing as a broken line. This end position represents the transport position in which the agricultural machine extends substantially coaxial to the tractor.

Additionally, gear system 14 is flange mounted on the end of main frame 1 shown on the left of the drawing. Gear system 14 is in driving connection with the undepicted motor drive of the tractor via drive shaft 15, which is formed as a universal joint

shaft. The driving of mower 2 and conditioning apparatus 3 originates from gear system 14.

In the embodiment shown in the drawing, conditioning apparatus 3 consists of rotor shaft 16, which is equipped with a plurality of substantially V-shaped 'fingers', so-called tines 17. Rotating tines 17 seize the harvested crop, which has been cut by mower 2 and deposited in swathes on the soil surface, in the process of which it is conveyed "overhead" while simultaneously being processed (conditioned) and then redeposited on the soil surface. The design and function of such a conditioning apparatus are already well known. Instead of the rotor shaft equipped with the proposed tines, it is also possible to use a different type of construction (e.g., a brush rotor).

The mower design is depicted with particular clarity in Figure 1 and Figure 4. Mower 2 comprises a design combining elements of a drum mower and a disc mower. Mower 2 supports itself in its working position on the soil surface by means of mower cutter bar 18, which extends substantially over the entire mower width. Mower cutter bar 18 disposes of bearings and driving elements for multiple (six in the embodiment pictured here) mower discs 19. Mower discs 19 rotate in a coplanar configuration immediately above mower cutter bar 18. They are oval-shaped and equipped with cutting knives 20. Drums 21 are mounted on the respective outside mower discs to enable improved conveyance of the harvested product towards the center.

It is also possible to equip the respective next mower discs 19 from the outside with drums 21, depending on requirements. It should be noted that this involves an essential design feature of the specified mower 2. As is particularly visible in Figure 4, three of the provided mower discs 19 are equipped with drums 21. Viewed from left to right in relation to the drawing, this involves the first two mower discs 19 and the right-hand, outer mower disc 19.

While mower cutter bar 18 extends across the entire mower width, mower frame 11 (as viewed in the drawing according to Figure 4) merely links up left-hand, second drum 21 with outer, right-hand drum 21. In other words, this means that mower frame 11 is kept shorter than mower cutter bar 18 by an amount substantially corresponding to the working width of first mower disc 19. This serves to create a free space indicated by arrow 22 above first drum 21, into which gear system 14, which is flange-mounted on main frame 1, can protrude. In order to further increase the size of free space 22, the overall height of left-hand, first drum 21 in Figure 4 is kept lower (upper edge 24) than remaining drums 21. This means, however, that the available working width can be fully equivalent to the maximum admissible transport width, since all the structural components of the agricultural machine are accommodated within the mower width. For the rest, mower frame 11, together with second drum 21, right-hand, outside drum 21, and mower cutter bar 18, form a self-contained, stable, approximately rectangular frame. Despite its lightweight, compact design with a low overall height, mower 2 is characterized by a large working width, a low degree of required constructional effort, and high stability.

The driving elements for mower 2 and conditioning apparatus 3 are formed as follows:

Figure 5, in particular, shows how gear system 14 is flange-mounted on main frame 1, as mentioned above. The connection can be made using additional bearing bracket 23. Gear system 14 (cf. Figure 3) disposes of input bevel gear drive 25, via the intermediary of which drive shaft 15 (cf. Figure 1) is in driving connection with first spur gear 26. Bevel gear drive 25 features input shaft 25', which runs in parallel with universal joint shaft 15 in order to prevent non-uniformity. Spur gear 26 is mounted on intermediate shaft 25" and is linked with further spur gear 27 through a meshing connection. Spur gear 27 is mounted in a torsionally rigid manner on input shaft extension 28. Two spur gears 30 and 31 are mounted on further input shaft extension 29 in a non-displaceable manner. Spur gear 31 is in constant driving connection with spur gear 27.

Spur gear 30 is in driving connection with additional spur gear 33 via the intermediary of chain/rope/belt drive 32 (chain belt or toothed belt). Once again, this spur gear 33 is mounted in a torsionally rigid manner on an input shaft extension 34. A first longitudinally-changeable universal joint shaft 35 links input shaft extension 28 with input shaft 36' of mower 2.

One end of a second universal joint shaft 36, which is also longitudinally-changeable, is in driving connection either with input shaft extension 29 or input shaft extension 34, as desired. At its other end, universal joint shaft 36 is linked to countershaft 37, which, together with chain/rope/belt drive 38 (chain belt drive or toothed belt drive), is used to drive rotor shaft 16 of the conditioning apparatus. The option is available of switching the connection of universal joint shaft 36, which means that rotor shaft 16 can be driven at different speeds. If universal joint shaft 36 is connected for this purpose with input shaft extension 34, then rotor shaft 16 rotates at its highest speed. If universal joint shaft 36 is connected to input shaft extension 29, then rotor shaft 16 is driven at a lower speed. In this manner, the possibility is provided of influencing the conditioning effect of rotor shaft 16 and tines 17, respectively.

As indicated above, the driving of mower discs 19 of mower 2 originates from input shaft 36'. Viewed in relation to Figure 4 from left to right, second mower disc 19 is driven by a vertical shaft, for which no further details are provided. The remaining mower discs 19 are driven from below, i.e., by driving means, which are provided in mower cutter bar 18.

The following sections refer to Figures 6 and 7 in order to provide information that is more detailed on the pivot mounting of mower 2 in relation to main frame 1.

Viewed in relation to the direction of travel, two forward-projecting extension arms 40 and 41 are securely attached (e.g., welded) to main frame 1. The position of extension arms 40 and 41 can be seen particularly clearly in Figure 1.

It can be clearly seen, in particular from the depiction provided in Figure 6, that extension arms 40 and 41 feature tail parts 42 that extend downwards. Each tail part 42 is faced by an essentially vertically aligned strut 43, which, as can also be seen in Figure 6, is attached to mower frame 11, e.g., once again through welding. Each of tail parts 42 is connected to facing strut 43 of mower 2 by a lower parallelogram linkage 44 and an upper parallelogram linkage 45. The length of each of upper parallelogram linkages 45 can be adjusted by means of a twistable sleeve 46, thereby enabling the inclination of mower 2 to be adjusted in relation to the soil surface and thus also enabling adjustment, within certain limits, of the mower's cutting height.

In order to prevent mower 2 from dropping downwards when it is being lifted into its transport position corresponding to the depiction in Figure 7, two chains 47 are provided between extension arms 40 and 41 and mower frame 11. The end links of chains 47 are secured, in each case, to mower frame 11 by socket bolt 48 and to extension arms 40 and 41 by socket bolt 49. The coupling of mower 2 outlined above ensures that mower 2 is able to follow the unevenness of the ground while equally ensuring that it can also be transferred into a raised transport position.

In connection with the depiction according to Figure 1, mention has already been made of the fact that subframe 4, which carries wheels 9 and 10, is arranged in a pivotable manner in relation to main frame 1. Vertical, upward-pointing, fixed joint pieces 50 and 51, which are set at a slight lateral distance from each other, are located approximately at the center of subframe 4. Joint pieces 50 and 51 are connected to each other in their upper region by means of pins 52 and 53 (Figure 6).

Pin 53 passes through piston rod 54 of single-acting hydraulic cylinder 55. The front end (viewed in the direction of travel) of hydraulic cylinder 55 is mounted in bearing support 56 in a pivotable manner. Bearing support 56 is a fixed component of bearing plate 57, which is arranged beneath hydraulic cylinder 55, and which for its part, too, is attached to main frame 1.

Upon the charging of hydraulic cylinder 55, subframe 4 rotates counterclockwise. Wheels 9 and 10 follow this motion, so that main frame 1, mower 2 coupled thereto, and conditioning apparatus 3 are moved into the raised transport position given in Figure 7. The subsequent drop into the working position is carried out by means of the agricultural machine's own weight as soon as the hydraulic fluid has been able to escape from hydraulic cylinder 55 through the connecting pipe.

The coupling of conditioning apparatus 3 in relation to main frame 1 and the possibility of also preventing this apparatus from dropping unintentionally are explained in the following sections with reference to Figures 1, 8, and 9.

Supporting arms 60 and 61 are attached to conditioning apparatus 3. The top view according to Figure 1 shows how supporting arm 60 and extension arm 40, and supporting arm 61 and extension arm 41, respectively, lie on common axes of symmetry in relation to the longitudinal direction and direction of travel, respectively, of the agricultural machine. The upper, angled, and consequently forward-projecting ends 62 of supporting arms 60 and 61 are equipped with downward-pointing, open receiving elements 63. Receiving elements 63 accommodate extension arms 40 and 41 between them, whereby upper socket pins 49, which also serve to secure the chains, pass through both receiving elements 63 and extension arms 40 and 41. For the rest, these connections are formed as disconnectable pin-and-socket arrangements, so that conditioning apparatus 3 can be disconnected relatively easily from extension arms 40 and 41.

As described above, the connection between conditioning apparatus 3 and main frame 1 is designed in a manner that enables the relative movement of conditioning apparatus 3 in relation to main frame 1. For purposes of clarification, however, it should be mentioned that conditioning apparatus 3 supports itself on main frame 1 during normal operation in a manner whereby ends 62 of supporting arms 60 and 61 lie against the top of main frame 1. A further essential feature is the fact that the mower is fully freed from the weight of the conditioning apparatus.

It is frequently the case in agricultural practice that crops have to be harvested without being simultaneously processed (conditioned). To save the farmer from having to detach the conditioning apparatus in such cases, the proposed agricultural machine provides a simple-to-operate locking device, which ensures that the conditioning apparatus remains in its raised state (i.e., in an inoperative position) while the mower is lowered to the soil surface to harvest the crop. This optional operating position is shown in Figure 9. In this position, the drive connection for the conditioning apparatus is detached.

To achieve the purpose described above, locking hook 66 is mounted in a pivotable manner on bearing pin 65 between two side pieces 64 (Figure 8). In this connection, the length of locking hook 66 is dimensioned in a manner that enables it to overlap pin 52 when the agricultural machine's main frame 1 has been raised into the position that corresponds to its transport position. This position, in which locking hook 66 overlaps pin 52, is shown in Figure 8. From this position, mower 2 can be

brought into contact with the soil surface by lowering main frame 1, whereby, as can be seen in Figure 9, conditioning apparatus 3 is prevented from dropping downwards. It is then possible to mow without simultaneously conditioning the crop. An essential feature of the proposed arrangement is that all the driving elements for mower 2 and conditioning apparatus 3 are accommodated on main frame 1, and indeed within the effective mower width. This portion of the agricultural machine, which represents a high proportion of its weight, is supported on wheels 9 and 10. Accordingly, mower 2 and conditioning apparatus 3 are freed from this proportion of weight. Furthermore, the mower and the conditioning apparatus are mounted on main frame 1 separately. This provides some crucial advantages. For one, the mower can easily follow the unevenness of the ground and, for another, the conditioning apparatus can be left on the agricultural machine even if it is not itself due to be used. Furthermore, the arrangement described has the significant advantage that costly balancing devices for the mower and/or the conditioning apparatus can be fully dispensed with. In this context, it is also important to note that the necessary protective devices (protective hoops, fabrics, and the like) can be attached to main frame 1, as well, i.e., that even these devices do not influence the weight of the mower. Ultimately, the conditioning apparatus used, which, in the embodiment depicted, is equipped with substantially V-shaped, splayed tines, can be replaced with a conditioning apparatus of a different design at any time, e.g., a design that makes use of plastic brushes, particularly since, in these cases, it is not necessary for a separate gear system to be provided for each conditioning apparatus for the purpose of driving it at different speeds. The situation becomes even simpler if the choice is made to simply swap between a variety of rotor shafts with various designs of conditioning tools while keeping the conditioning apparatus unchanged.

Patent Claims